

USDA Climate Change Activities

DOE Regional Carbon Sequestration Partnership
Annual Program Review Meeting



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Global Change Program Office
November 16, 2004



Importance of Climate Change to Agriculture and Forests

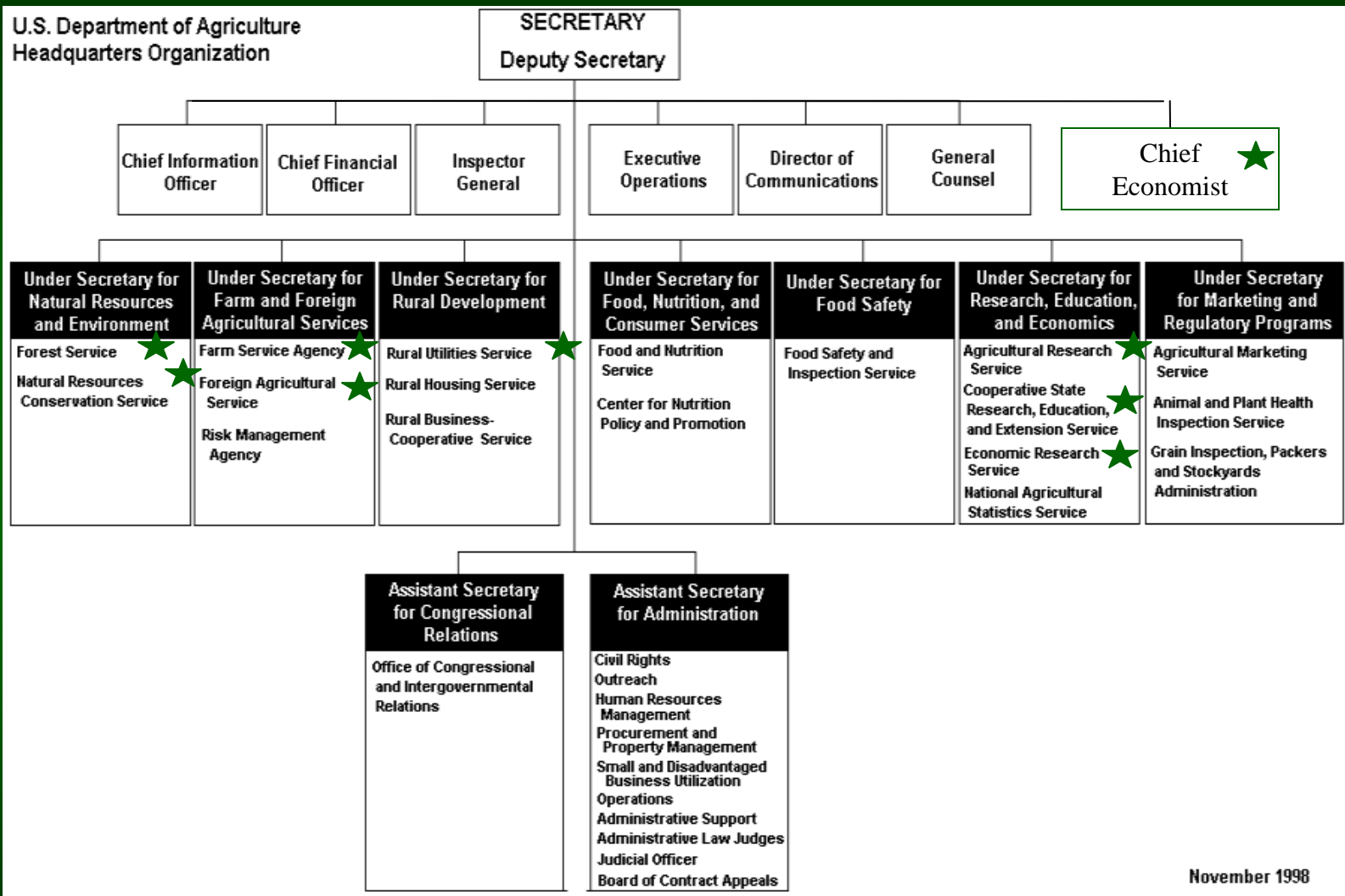
- Natural resources are potentially vulnerable to climate change
- Agriculture and forests are important sources and sinks of greenhouse gases
 - Agriculture contributes 7% of US emissions
 - US sinks offset 15% of overall emissions
- Carbon sinks offer a potentially significant low-cost opportunity to address climate change



USDA's Climate Change Activities

- **Implement actions under USDA's conservation programs**
- **Develop methods for estimating sources and sinks from agriculture and forestry**
- **Support voluntary agreements with the private sector**
- **Support the development of technologies and practices through the Climate Change Technology Program**
- **Implement Climate Change Science Program Strategic Plan**
- **Cooperate with the Department of State on bilateral and multilateral agreements**

**U.S. Department of Agriculture
Headquarters Organization**





Roles of the USDA Agencies

- **ARS:** Assess potential impacts and vulnerabilities to agriculture; identifying opportunities to respond and adapt; develop technologies and practices to mitigate greenhouse gases
- **Forest Service:** Assess and manage potential impacts on forest productivity, health, disturbance processes, and species distributions; improve the information on carbon cycling and inventories, provide landowner assistance.
- **CSREES:** Support the national UV-B monitoring network; provides competitive grants to assess impacts; oversee major soil carbon study.
- **NRCS:** Provide technical assistance to farmers; help farmers plan and implement conservation systems; maintain soil survey and associated databases.
- **ERS:** Assess the economics of mitigation options and impacts of climate change on well-being of global and US agricultural producers and consumers.
- **Others with roles:** FSA, RUS, International Forestry, FAS, NASS

Greenhouse Gas Inventories

Agriculture's Contribution to U.S. Emissions

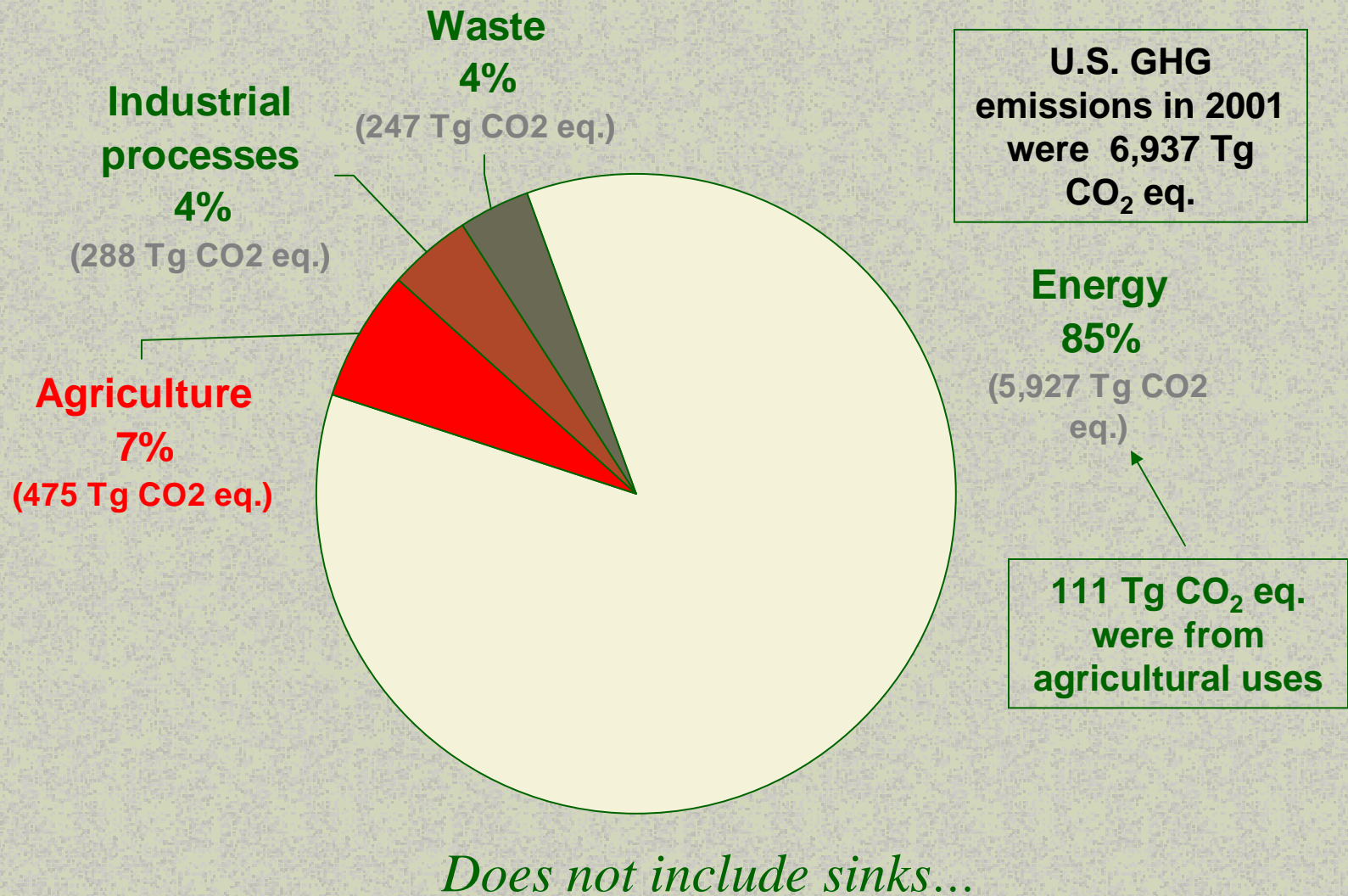
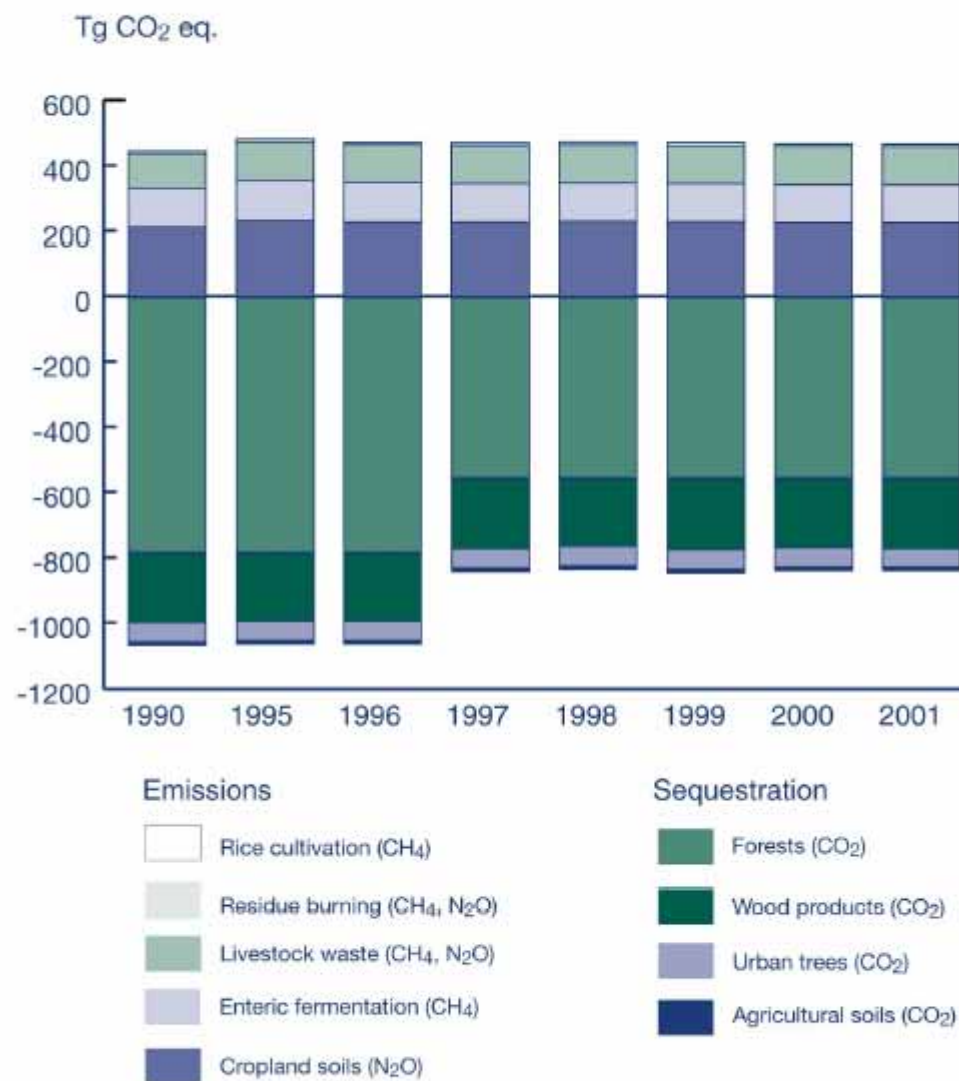



Figure 1-2
Agriculture and forestry GHG emissions and
sequestration for 1990, 1995-2001





USDA Contributions to the Revised DOE 1605(b) Guidelines

- Inventory methods for agriculture sources
 - Enteric fermentation
 - Animal waste
 - Rice cultivation
 - Crop residue burning
 - Nutrient and lime applications
- Inventory methods for agricultural soil carbon sequestration
 - COMET model – produces default sequestration rates
 - Protocols for periodic sampling
- Inventory methods for forest and wood products carbon stocks and fluxes
 - Default tables by region, species, management intensity, productivity class
 - Measurement and sampling protocols
 - Guidance on the use of models
- Methods for estimating reductions from carbon sequestration



COMET: CarbOn Management Evaluation Tool

- Provides carbon fluxes for agricultural land management practices
- Requires simple input data for each tract of land
- Underlying model is:
 - Based on results from the Century SOM Model
 - Based on 20 Land Resource Regions with subdivisions
- NRCS computed:
 - An average of 3.6 million records per LRR (90 million total)
 - Calculations take ~ 2500 CPU hours
 - Takes ~20 working days to recalculate entire dataset
 - ~ requires 60 Gig of data storage

Specify your parcel's information

Date: Apr 25, 2004 12:05:17 PM

- 1 Parcel Name (optional): ?
- 2 Units for area and amounts: ☒ English ☐ Metric ?
- 3 Parcel Size: acres ?
- 4 Choose State:

Montana
North Dakota
South Dakota
Minnesota

 ?
- 5 Choose County:

Broadwater
Carbon
Carter
Cascade
Chouteau

 ?
- 6 Select the dominant soil texture near the surface:

Clay Loam
Loam
Loamy Sand
Sandy Loam
Silt Loam

 ?
- 7 Is this a hydric soil? ☒ No ☐ Yes ?
- 8 Enter the management history for this parcel: ?

For this time period: **Choose Rotation:** ?Landscape position
and base history

upland non-irrigated (pre 1970's)
lowland non-irrigated (pre 1970's)
irrigation (pre 1970's)

1970's through mid-1990's

dryland: spring wheat-small grain-fallow
dryland: spring wheat-fallow
dryland: spring wheat-sunflower-fallow

Current management
(last decade)

irrigated: small grain-6 yrs alfalfa
dryland: spring wheat-small grain-fallow
dryland: spring wheat-fallow

Management over report period
(next decade)

irrigated: small grain-6 yrs alfalfa
dryland: spring wheat-small grain-fallow
dryland: spring wheat-fallow

For this time period: **Choose Tillage:** ?

1970's through mid-1990's

intensive
reduced
none

Current tillage
(last decade)

intensive
reduced
none

Tillage over report period
(next decade)

intensive
reduced
none

Actions:[Get Carbon Storage](#)[Start Over / Clear Form](#)[View Manual](#)[Learn About This Project](#)

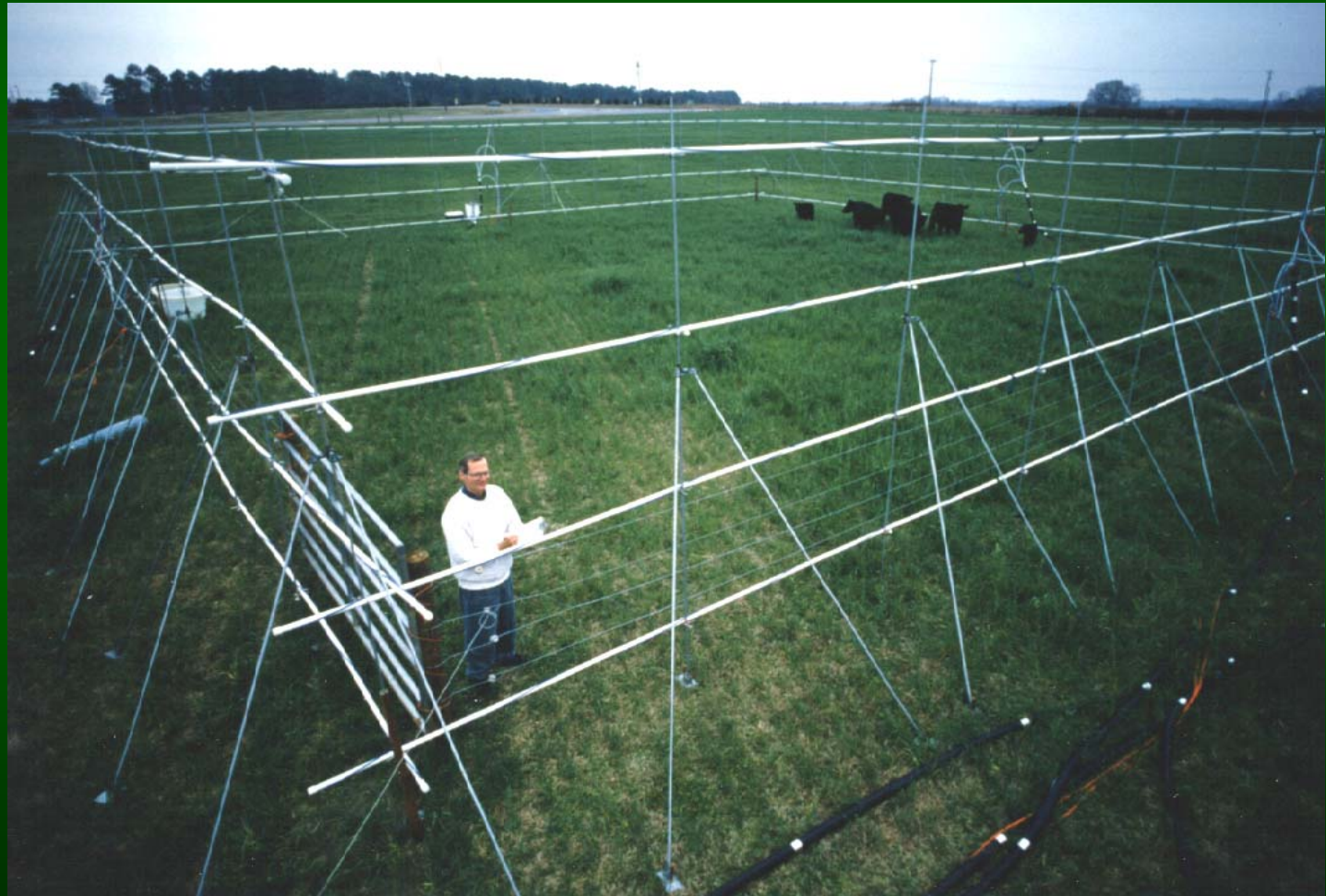
Parcel Description and History**Report Date:** Apr 25, 2004 12:06:43 PM**Management:****Parcel Name:** case study 1**Base** upland non-irrigated (pre 1970's); intensive tillage**Parcel Size:** 320.0 acres**70's - 90's** dryland: spring wheat-fallow; intensive tillage**Location:** Chouteau , Montana**Current** dryland: spring wheat-fallow; intensive tillage**Soil:** non-hydric Loam**Next** dryland: spring wheat-fallow; no tillage**Predicted Change in Soil Carbon for the Parcel****Annual Change for 2005**

	Change in Carbon	% Uncertainty
Total tons Carbon per year	50	38%
Total tons CO2 Equivalent per year	183	38%
Average change in organic matter (%) per year during the reporting period:	0.4%	

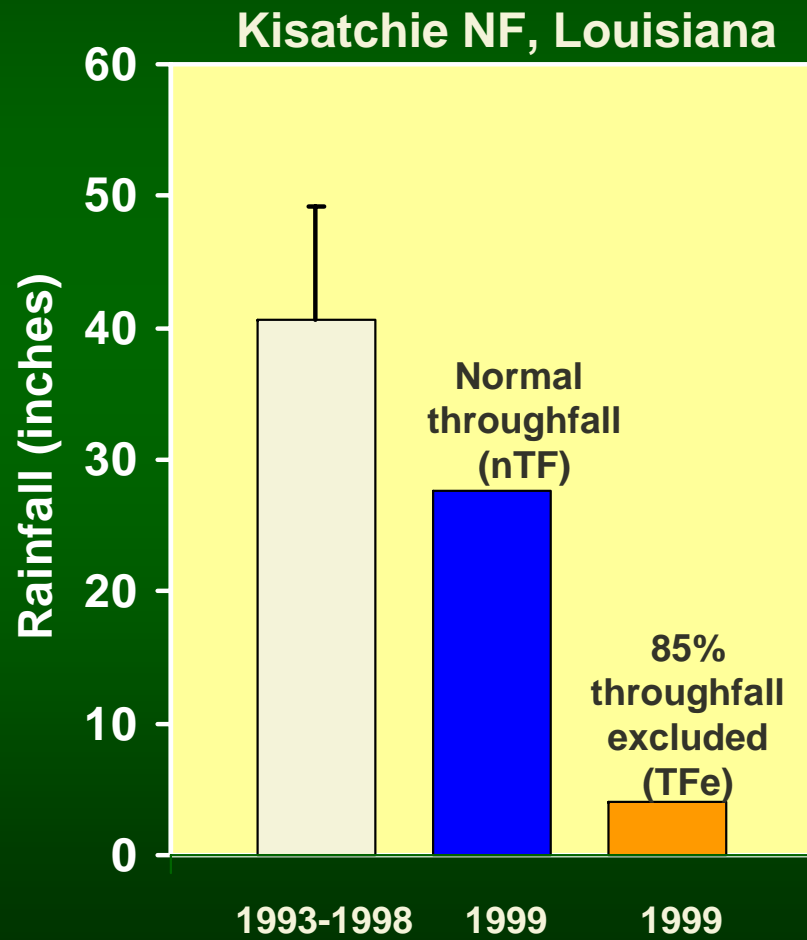
Actions:[About This Report](#)[View Fuel and Fertilizer Changes](#)[Print](#)[Save Page to File](#)[View Manual](#)[Go To Start Page](#)

Support for the Climate Change Science Program

Atmospheric Composition: Development of open-path laser techniques to measure methane emissions from ruminants



Water Cycle: Pine ecophysiology response to reduced rainfall



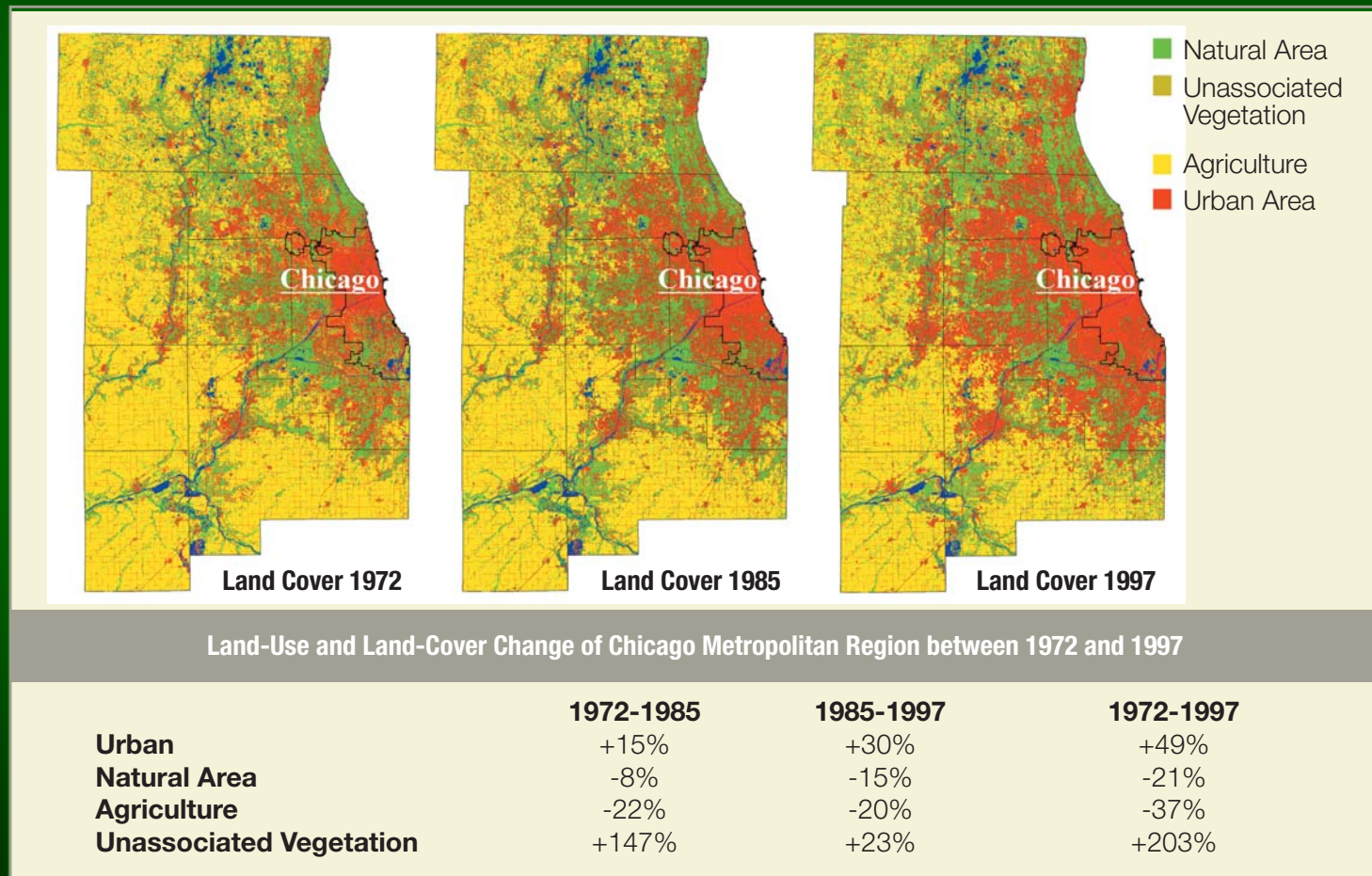
Normal throughfall in 1999



85% throughfall excluded in 1999

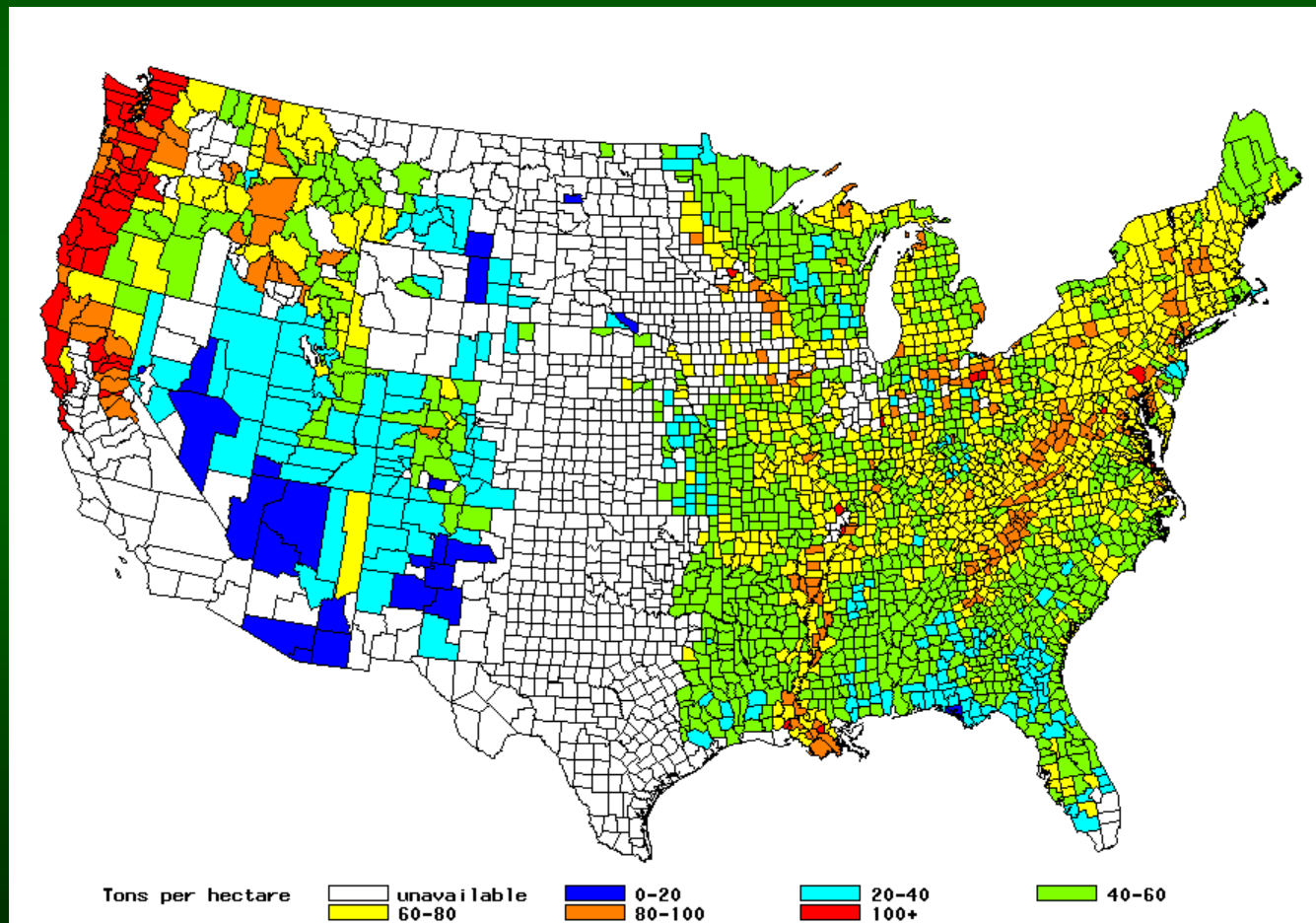


Land Use/Land Cover Change: Land cover changes in the Chicago Region show declines in agriculture and natural areas



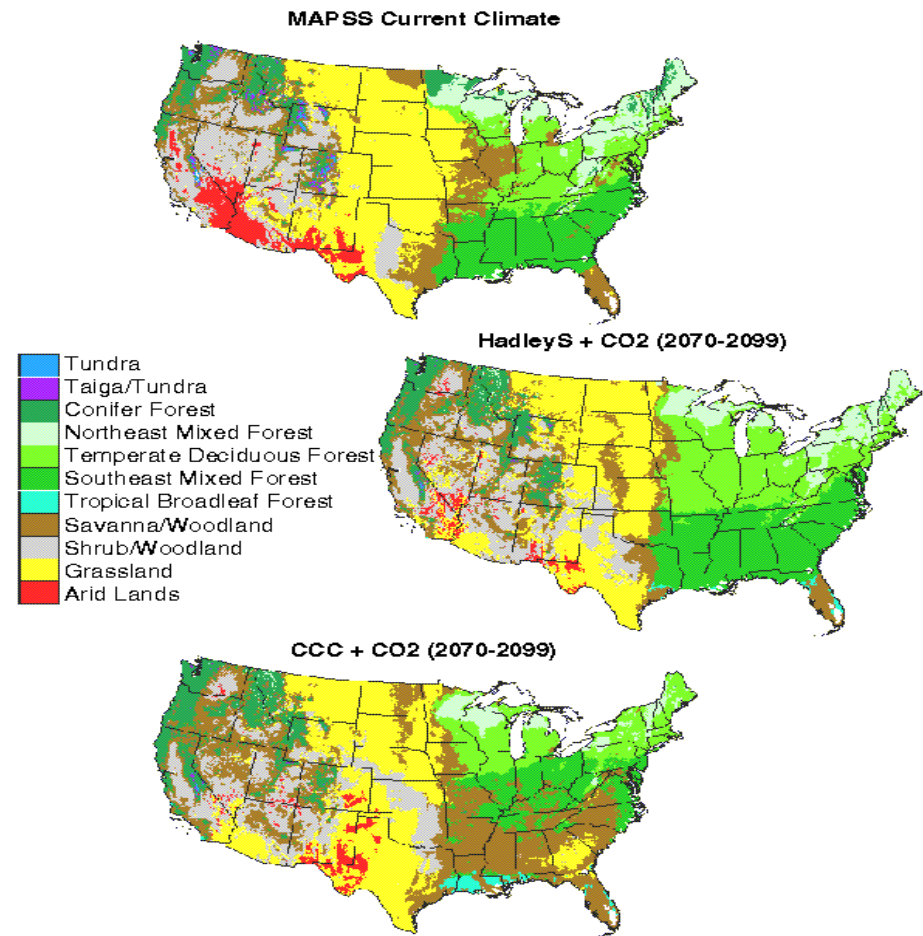
Carbon Cycle: Carbon stocks and stock changes estimated from forest inventory data

Tree carbon per hectare by U.S. county



Ecosystems: Changes in vegetation distributions

- Results influenced by
 - Treatment of CO₂ effects
 - Particular climate scenario
- Results indicate
 - Direction of change
 - Magnitude uncertain
- Sensitive to climate
 - Species composition
 - Vegetation boundaries



Human Contributions and Responses: Nutrient management and precision agriculture

- The U.S. emitted 20 MMTCE from fertilizer and manure land application
- USDA/ARS is building a **national network** called GraceNET to evaluate alternative management practices



Decision Support: Carbon dioxide affects glyphosate efficacy in the field.

Ambient CO₂

2 x CO₂



Observations: Improving carbon measurement and observation systems

**Cooperative
research with Los
Alamos National
Laboratory**

**Laser-Induced
Breakdown
Spectroscopy
(LIBS)**





USDA Responsibilities in CCSP Synthesis & Assessment Reports

1. USDA role: lead agency

Relationship between observed ecosystem changes and climate change (with USGS)

Preliminary review of adaptation options for climate-sensitive ecosystems and resources. (with EPA)

2. USDA role: support agency

Updating scenarios of GHG emissions and concentrations in collaboration with CCTP

North American carbon budget and implications for the global carbon cycle.



Web Sites

■ 1605b information

- <http://www.usda.gov/agency/oce/gcpo/greenhousegasreporting.htm>
- <http://www.eia.doe.gov/oiaf/1605/frntvrhg.html>
- <http://www.pi.energy.gov/enhancingGHGregistry/index.html>

■ USDA Greenhouse Gas Inventory

- <http://www.usda.gov/agency/oce/gcpo/ghginventory.html>

■ Third USDA Symposium on Greenhouse Gases and Carbon Sequestration in Agriculture and Forestry

- <http://soilcarboncenter.k-state.edu/conference>